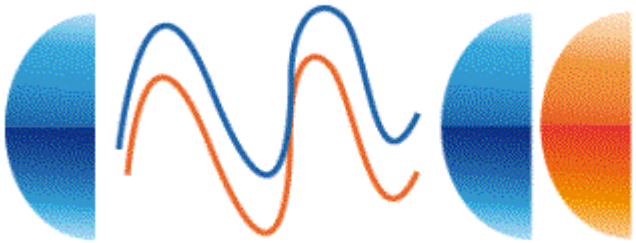


Centro Euro-Mediterraneo
per i Cambiamenti Climatici

# Intraseasonal Hindcasts at CMCC.

**Outline:**

**-CMCC-INGV Prediction system**

**-Preliminary ISO results**

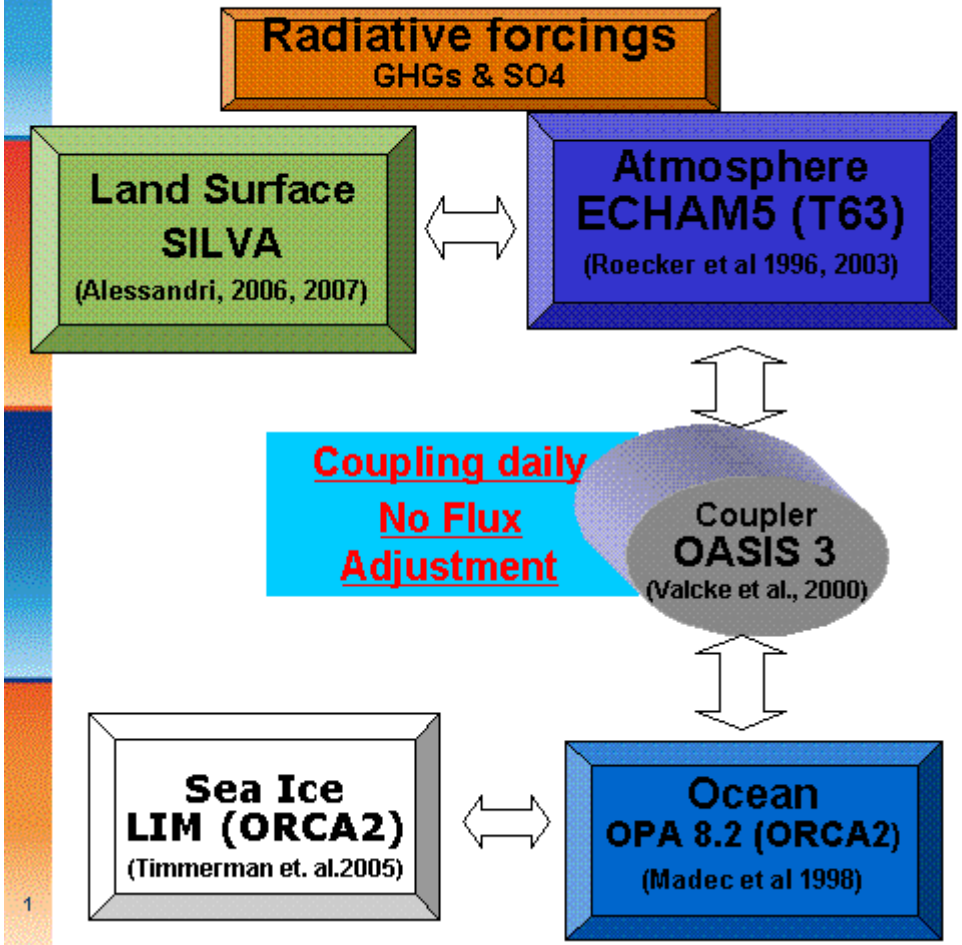
**-ISM onset prediction**

A. Alessandri, A. Borrelli and A. Navarra

CLIVAR/AAMP10 – Busan, South Korea, 18-19 June 2010

# The coupled Model components

Alessandri et al. 2010




Atmosphere: Echam-5 -Spectral T63 (~1.8°x1.8°) & 19 vertical levels

Land Surface: SILVA (Surface Interactive Land VegetAtion)

Ocean: OPA8.2 – 2° longitude - 0.5° - 2° latitude - 31 Vertical Levels

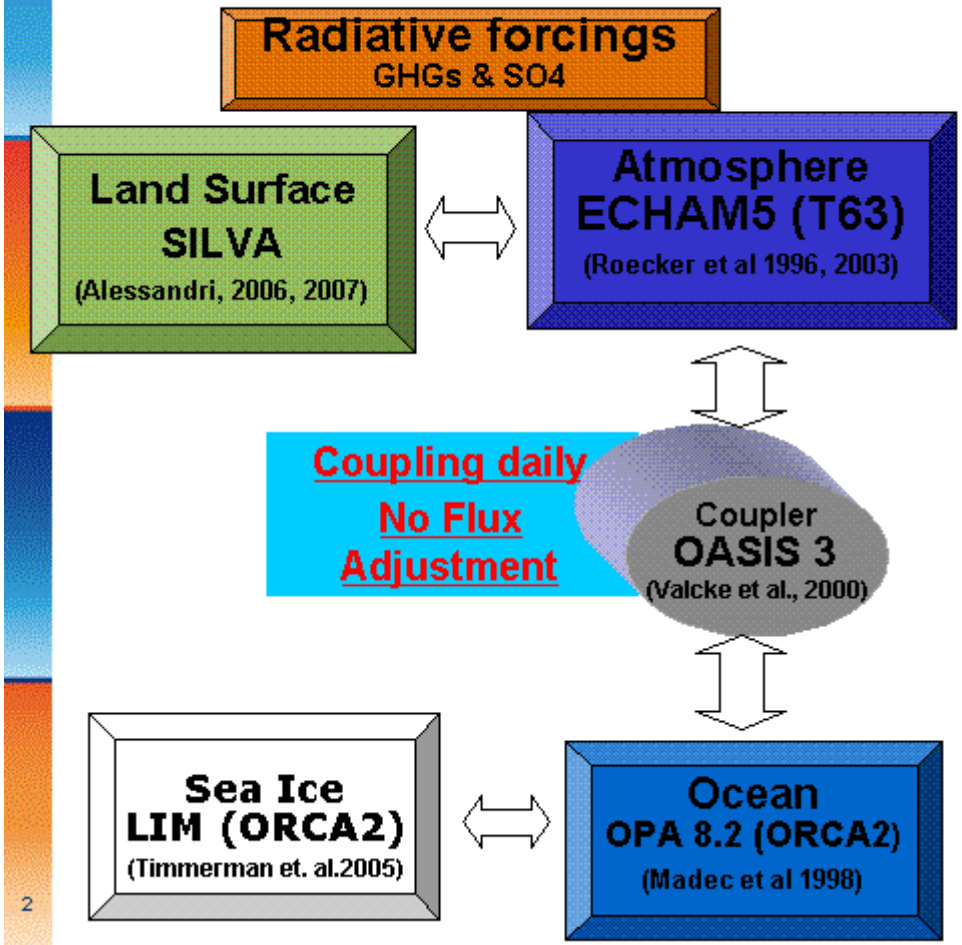
Coupler: OASIS3 (Ocean Atmosphere Sea Ice Soil)

Sea Ice Dynamics: LIM (Louven laneuve sea-Ice systeM)

Radiative boundary forcing: GHGs, direct and indirect effects of anthropogenic sulphate aerosols

http://www.ecmwf.int/research/EU_projects/ENSEMBLES/exp_setup/boundary/boundary_forcing.html

# The coupled Model components




**Off line Initialization Tools**

CMCC-INGV Global Ocean Data Assimilation System(CIGODAS)

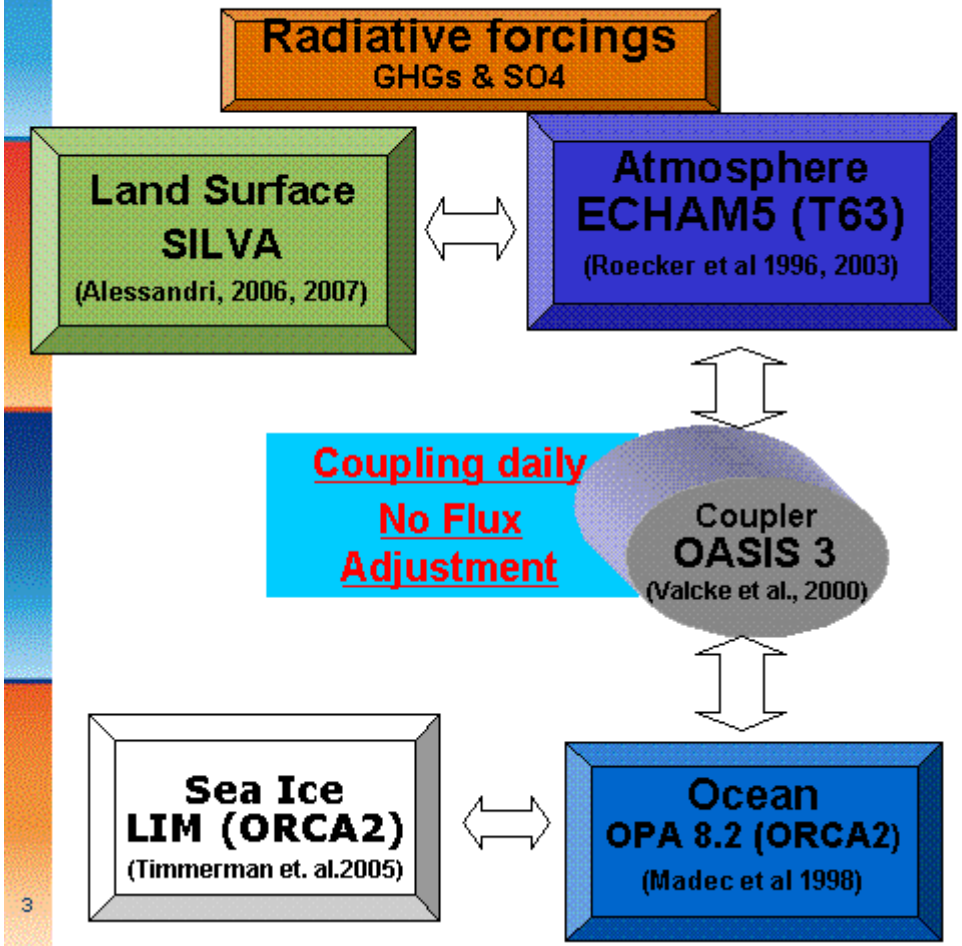
**Assimilated Ocean initial condition production:**

T & S - OI assimilation
SOFA 3.0
(De Mey and Benkiran 2002)

Bellucci, Masina, Di Pietro & Navarra, 2007

-Di Pietro & Masina, 2009

# The coupled Model components




**Off line Initialization Tools**

Atmospheric IC from ERA-Interim Reanalysis

Spectral & Time interpolation
INTERA
(Kirchner, 2001)

Assimilated Ocean initial condition production:

T & S - OI assimilation
SOFA 3.0
(De Mey and Benkiran 2002)

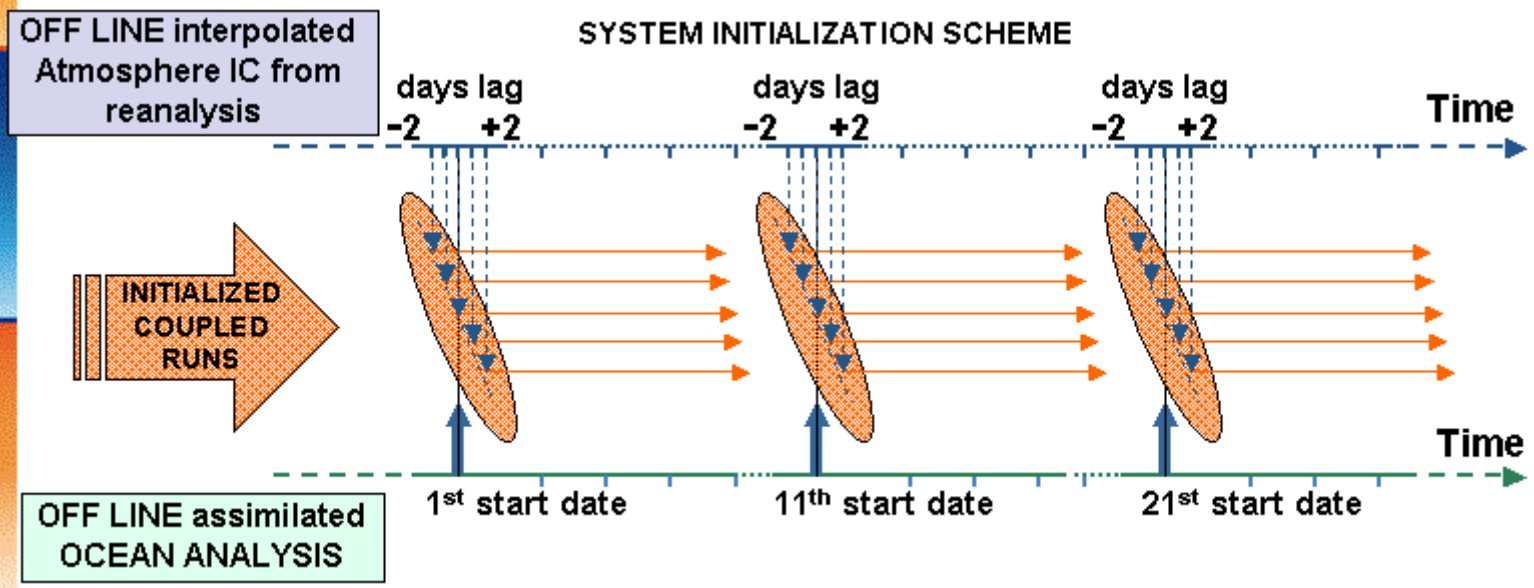
Bellucci, Masina, Di Pietro & Navarra, 2007

-Di Pietro & Masina, 2009

# Retrospective forecasts performed

**Hindcasts have been performed for the period 1989-2009**
**3 start dates each month for each year**
**Ensembles of 5 forecasts, each integration 2 months long**

**5 Athmospheric IC from lagged days (-2:0:+2)** → **5 perturbed i.c. for each start date, each year**

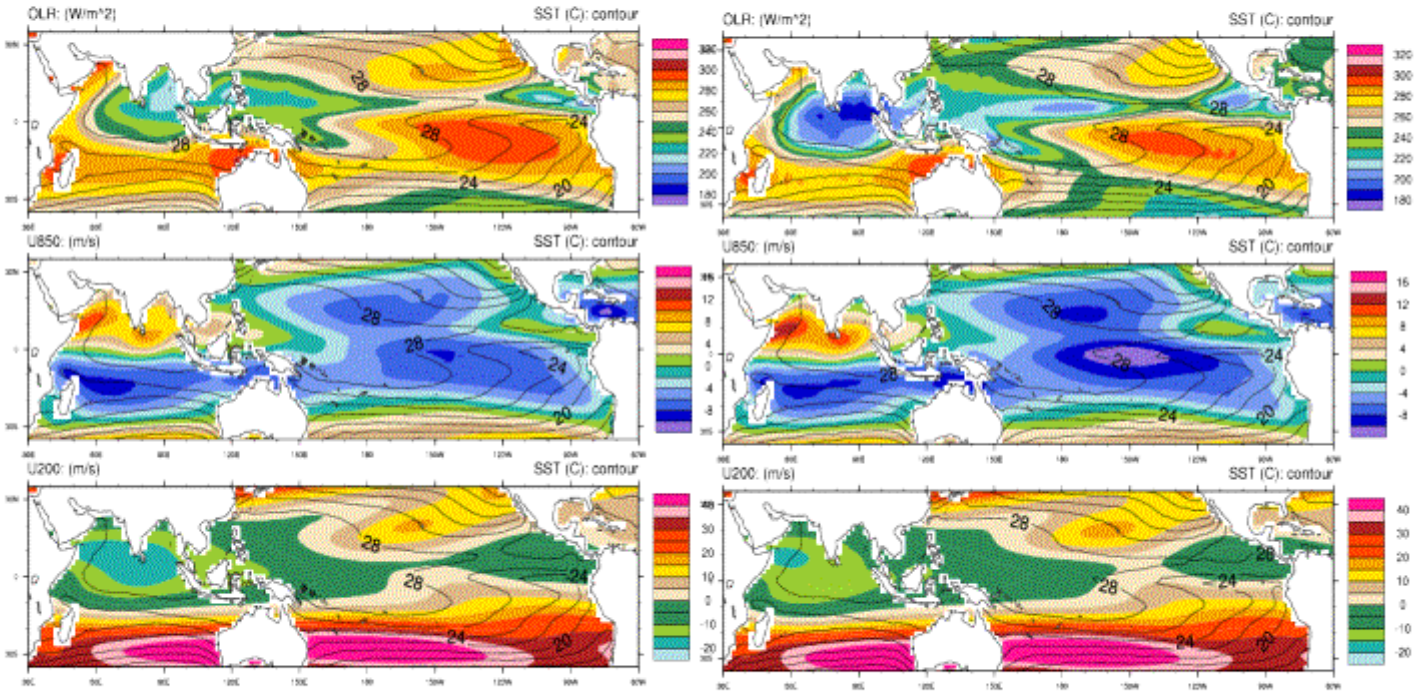


# Climatologies - Boreal Summer (MJJASO, 1989-2008)

## Era Interim

## Model (lead-time 6-15 days)

**Boreal Summer - MJJASO**

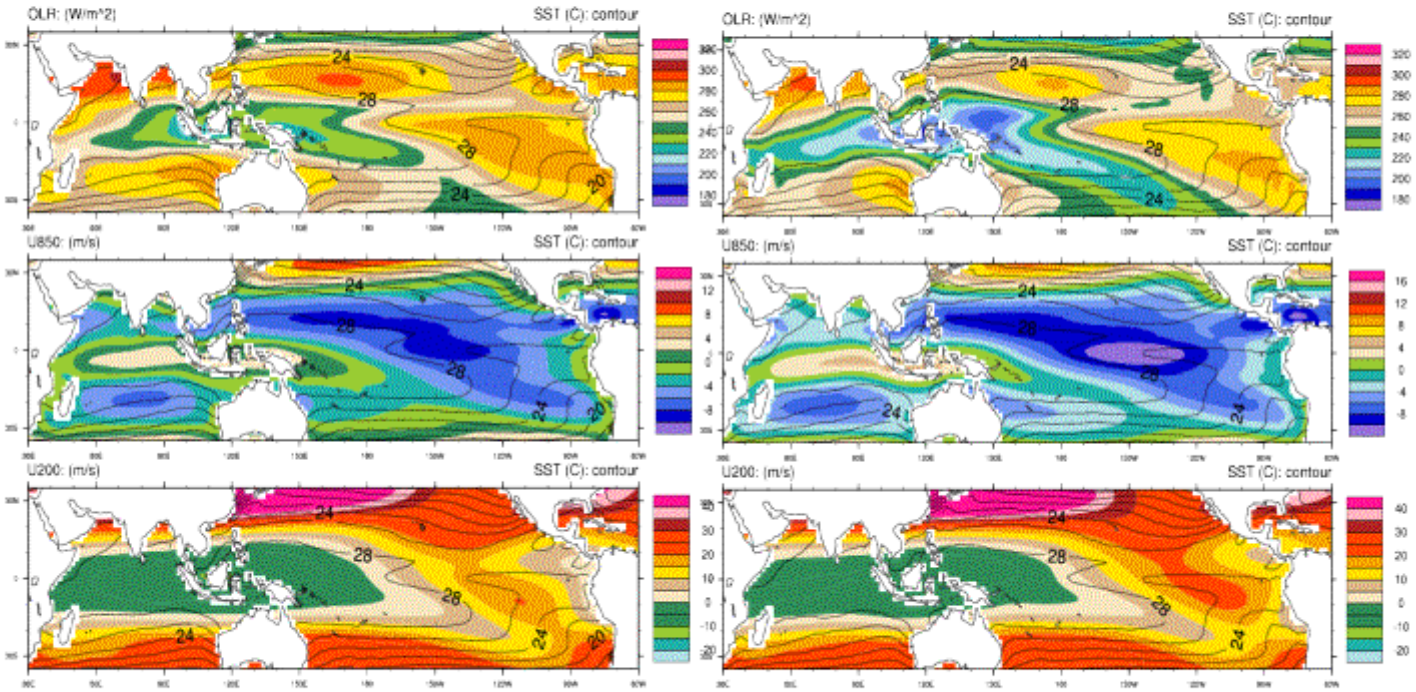


# Climatologies – Boreal Winter (NDJFMA, 1989-2008)

## Era Interim

## Model (lead-time 6-15 days)

Boreal Winter - NDJFMA

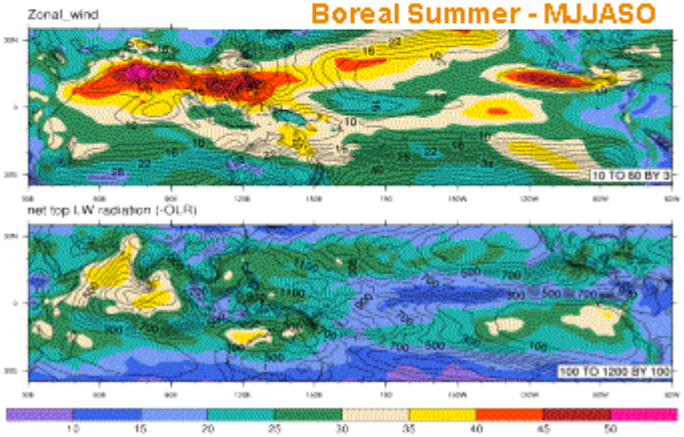


# Total variance (1989-2008) & Filtered (20-100d) vs unfiltered

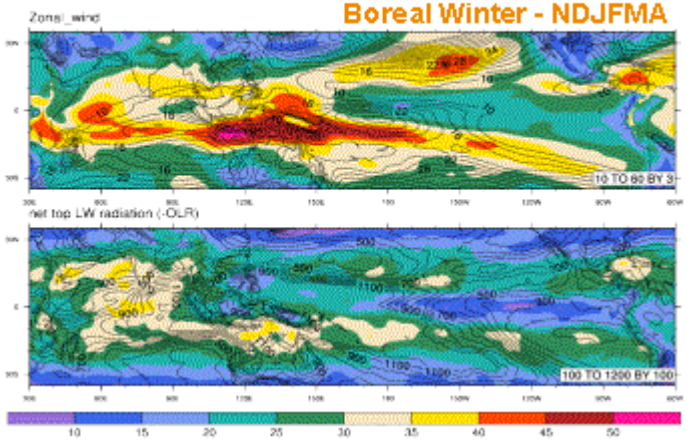
## Contour: Total Variance -- Shaded: Filtered (20-100d)/Total Variance ratio

### Era Interim

Boreal Summer - MJJASO

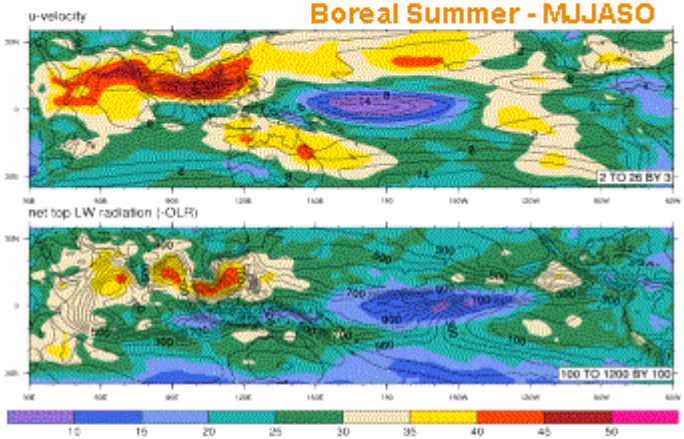



Boreal Winter - NDJFMA

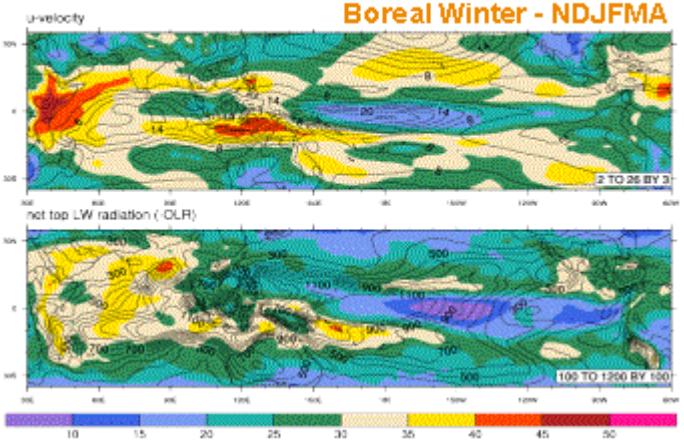



### Model ensemble means (lead-time 6-15d)

Boreal Summer - MJJASO




Boreal Winter - NDJFMA

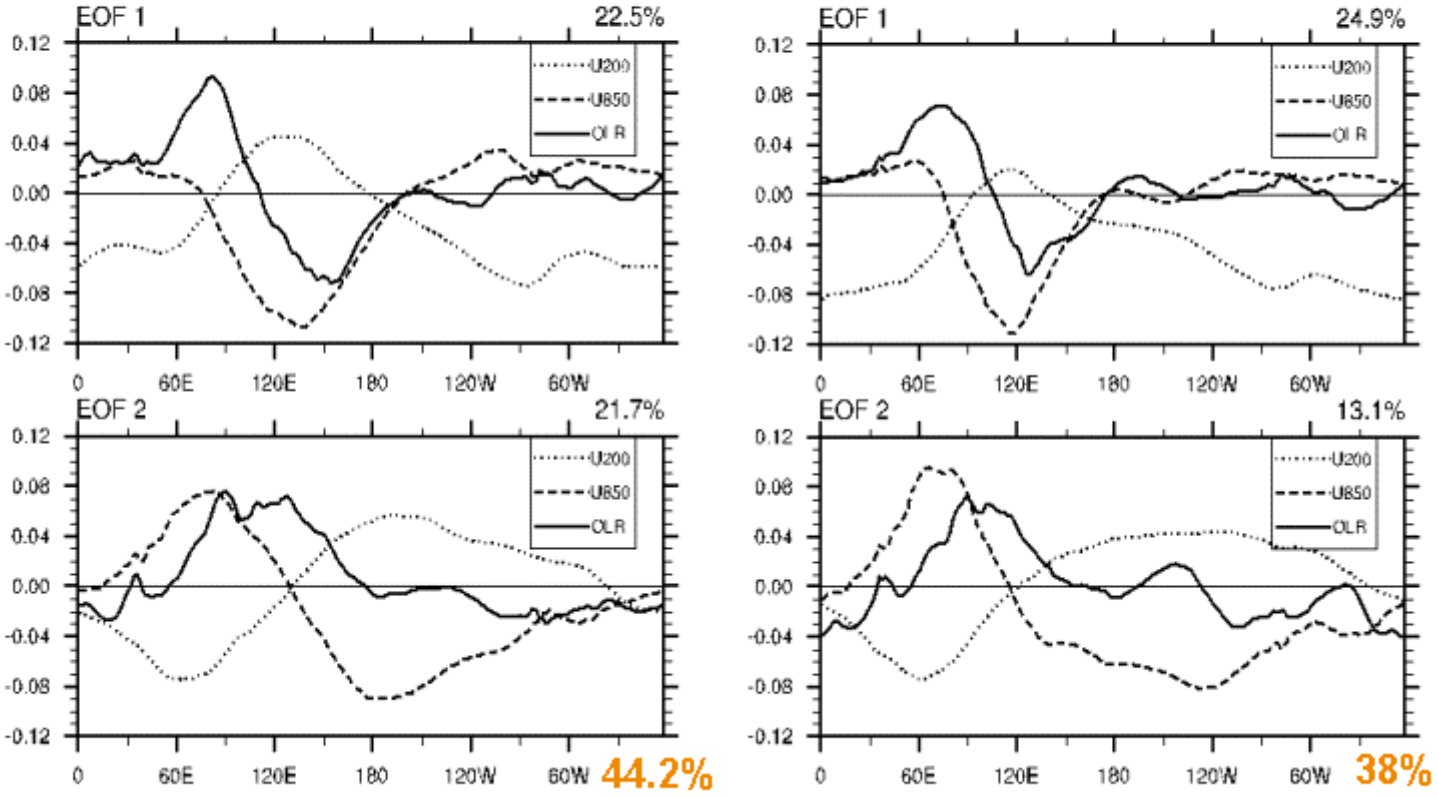


# Multivariate CEOF technique applied on filtered (20-100d) data

## Era-Interim

## Model (lead-times 6-15 days)

### Multivariate EOF 15N-15N 1989-2008

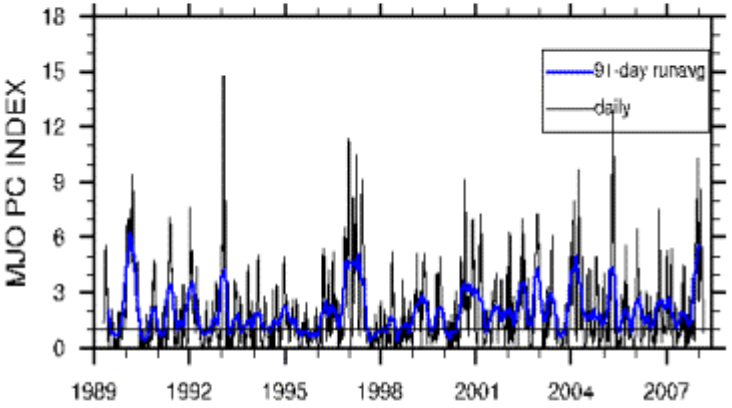


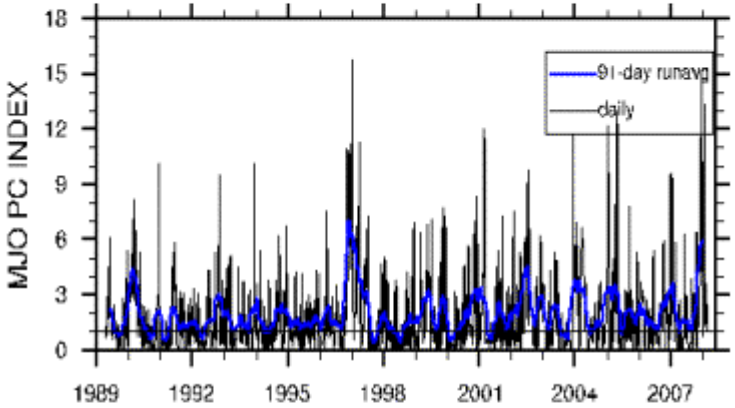
# Multivariate CEOF technique applied on filtered (20-100d) data

## Era-Interim

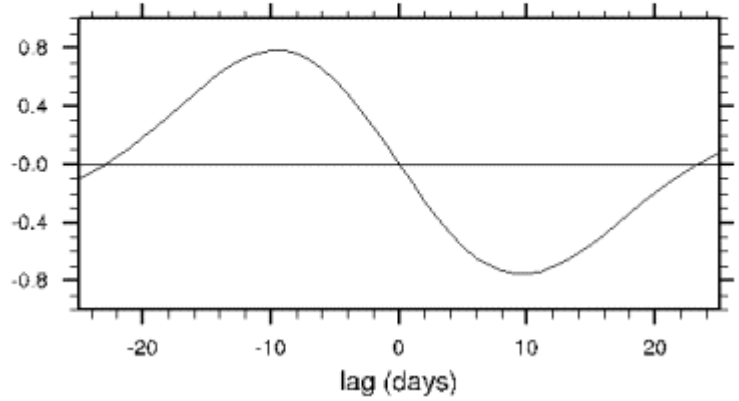
## Model (lead-times 6-15 days)

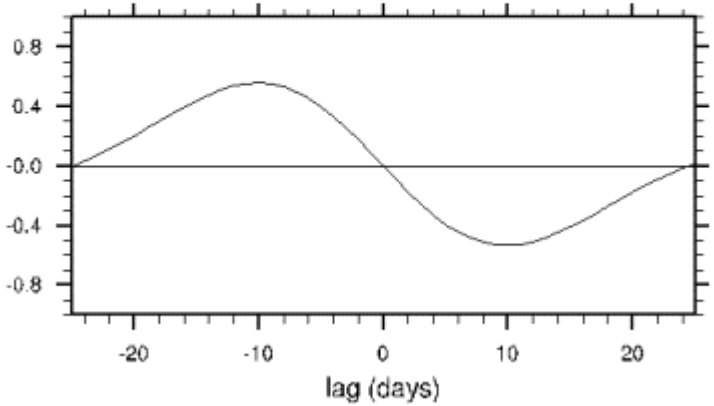
### MJO amplitude index ($PC1^2 + PC2^2$) 15S-15N: 1989-2008



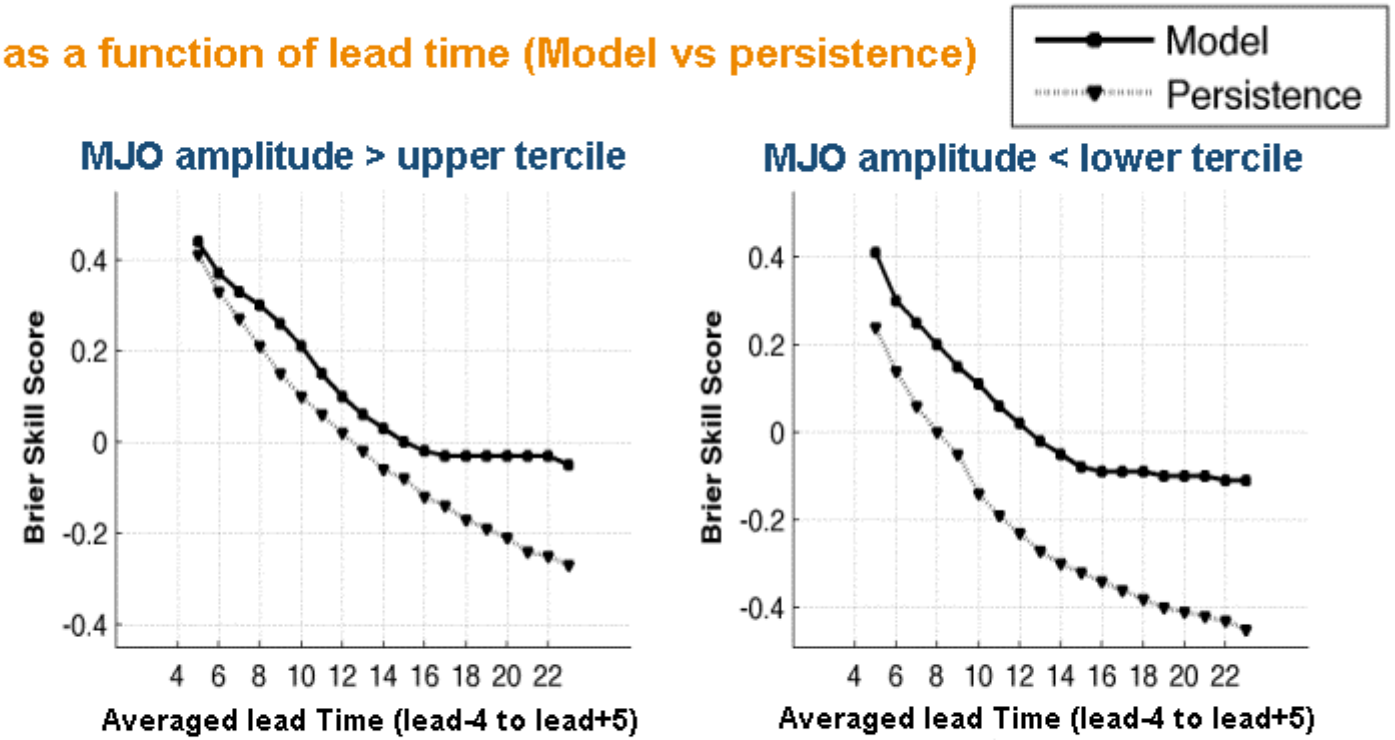

### Cross Correlation: PC1 vs PC2 - 1989-2008



# Anomalous MJO amplitude ($PC1^2 + PC2^2$) prediction: above normal (upper tercile) & below normal (lower tercile)

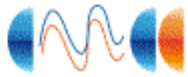
## Skill as a function of lead time (Model vs persistence)



# Predictability of the Indian Summer Monsoon onset
# Sensitivity to realistic atmospheric initial conditions

**See also Poster at the Monsoon Intraseasonal Variability Workshop**

Alessandri et al., 2010, In preparation



## Sensitivity to Atmosphere ICs

Atmosphere ICs from ERA-Interim (*ERAINI*)

Experiment Ics from AMIP-Type runs (*AMIPINI*)

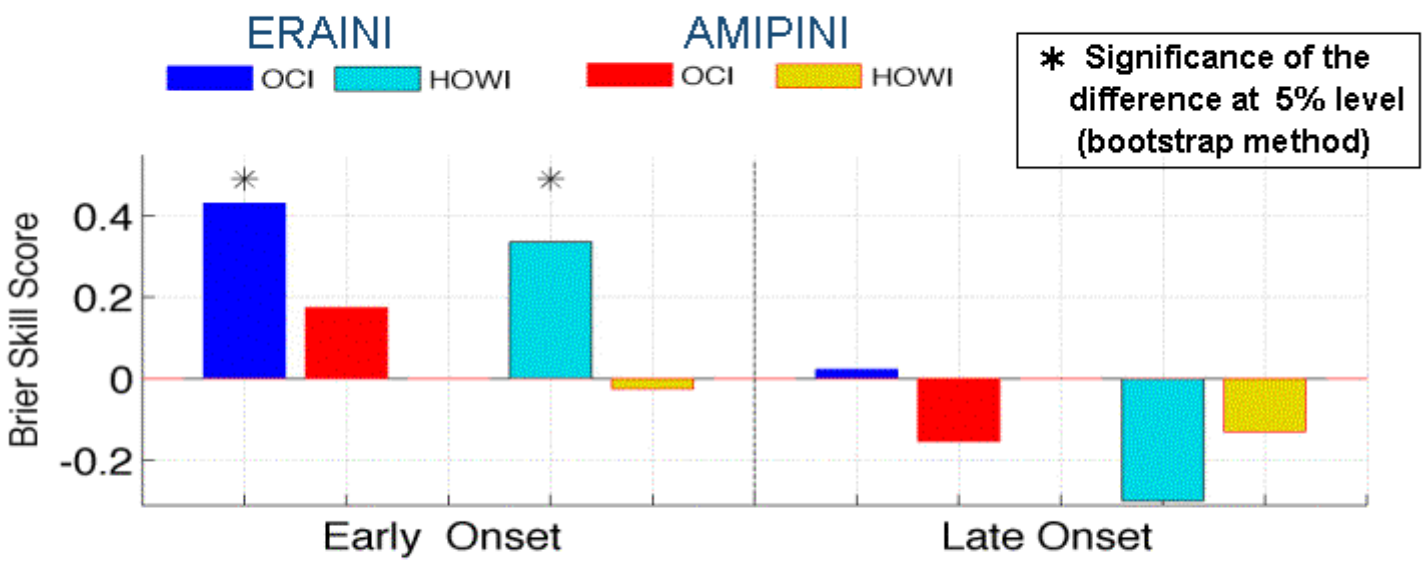
- Atm **T63** (1.87°x1.87°)

- Same ocean model & oceanic ICs

- Retrospective forecasts have been performed for the period 1989-2005

- Start dates May

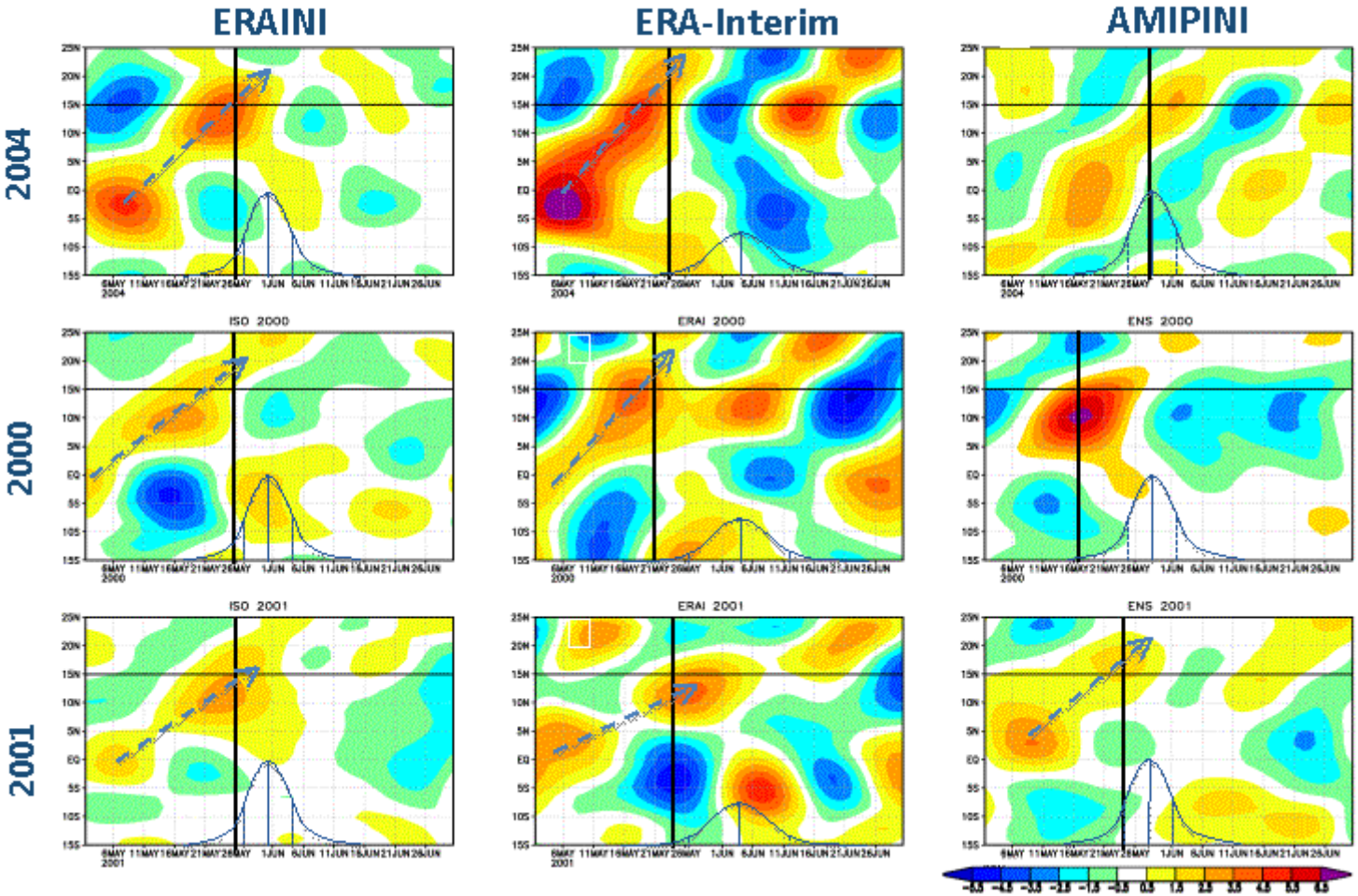
# Sensitivity to Atmosphere ICs: Monsoon onset predictability




**OCI**: Onset Circulation Index (Wang et al., 2009)

**HOWI**: Hydrological Onset & Withdrawal Index (Fasullo and Webster, 2003)

# Sensitivity to Atmosphere ICs: Intraseasonal Variability (20-100d filtered zonal wind; 65-85E average)



## Summary

- CMCC-INGV contributes to the ongoing CliPAS ISO hindcast experiment with the latest development of its short term climate prediction system.
- Preliminary analysis shows that the system is able to reproduce eastward propagating intraseasonal wind and precipitation anomalies in good agreement with observations.
- The system shows a considerable skill in predicting above normal (upper tercile) & below normal (lower tercile) MJO amplitude ($PC1^2 + PC2^2$).
  - ➢ It always performs better than persistence
  - ➢ It display a positive skill till leads 11-20 (8-17) for above (below) normal MJO amplitude
- Realistic initialization of the atmospheric component is shown to significantly contribute to the predictability of early than normal monsoon onsets.
  - ➢ In three out of the 5 earliest monsoon years, northward propagating ISV modes appear to trigger onset. Phase initialization of this modes contribute to predictability.

… analysis just started …